



Clinical Profile, Visual Outcome and Prognostic Factors of Open Globe Injuries Presenting to Tertiary Care Institute of North India

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Abstract

Purpose: To study the clinical profile, visual outcome and prognostic factors of open globe injuries.

Methods: The prospective study was conducted from October 2018 to July 2020. The mechanisms of injury were classified on the basis of Birmingham Eye Trauma Terminology. Classification of wound locations was done according to the Ocular Trauma Classification Group.

Results: Out of 75 patients with open globe injury 57 (76%) were male and 18(24%) were female. Open globe injury was common in males (p-value = .000). In present study Zone I was involved in 40 (53.33%) patients, zone II in 26 (34.66%) patients and zone III in 9 (12%) patients. In our study, open globe injury was more common in patients under age group in patients less than 40 years (p-value= .013). The most common agent causing injury was wood in 29(38.66%) patients.

Conclusion: The prompt diagnosis and timely mediation is warranted in the patients sustaining open-globe injury to prevent devastating visual impairment and blindness. In present study, zone III injury, uveal tissue prolapse, vitreous hemorrhage and vitreous prolapsed showed poor visual outcome but Hyphema came out to be important prognostic factors associated with poor visual outcome in patients with open globe injuries.

Keywords: Open Globe Injury; Relative Afferent Pupillary Defect; Visual Acuity; Intraocular Foreign Body

Introduction

Ocular trauma is an important cause of preventable ocular morbidity throughout the world. It leads to acquired unilateral as well as bilateral blindness and visual impairment. It constitutes about 1.5% of all the causes of blindness, 7% of all bodily injuries and 10-15% of all eye diseases. Ocular trauma can occur due to various activities such as agricultural, recreational, sports, home and road traffic accidents. The management of trauma has improved due to advances in diagnostic and treatment modalities like Computed Tomography (CT), Magnetic Resonance Imaging (MRI) scan, ultrasound and microsurgical techniques and vitreoretinal surgeries thereby improving visual outcomes in these patients. Ocular trauma has been classified by the Birmingham Eye Trauma Terminology (BETT) and Ocular Trauma Classification Group and subdivided it into open and closed globe injuries [1,2]. An open-globe injury is defined as a full thickness wound of the eye wall involving sclera, cornea or both which is vision-threatening and can lead to blindness. The annual global incidence rate of ocular trauma is 3.5/100,000 people worldwide [3]. The open-globe injuries result in poorer visual outcome compared to closed globe injuries [4,5]. The final visual outcome depends upon various prognostic factors such as the severity of the initial ocular trauma, extent of ocular structures involvement, preoperative visual acuity and timely diagnosis and treatment [6,7]. The current study was done to analysis the clinical profile, visual outcomes and prognostic factors of open-globe injuries.

Methodology

The prospective study was conducted from October 2018 to July 2020. Patients presenting with open globe injury were enrolled in the study. All age group patients were included in the study. Patients with corneal, scleral pathology, patients with follow up of less than six months and patients who do not want to participate were excluded from study. The occupation, the place of injury, agents causing injury, visual acuity, slit lamp examination, X-ray orbit and ultrasound of patients having open globe injury were recorded.

Primary repair of wounds was done in all cases and patients requiring vitreoretinal surgery were managed by vitreoretinal surgeon and were followed later on. The mechanisms of injury were classified as perforation, penetration, Intraocular Foreign Body (IOFB), rupture and mixed injury according to Birmingham Eye Trauma Terminology. Open globe injuries were classified according to the Ocular Trauma Classification Group. Zone I: isolated to cornea, Zone II: limbus to five mm posterior into sclera, Zone III: posterior to five mm from limbus.

Grading of injury based upon visual acuity of the involved eye at the time of presentation was done in five grades. Grade I: greater or equal to 6/12, Grade II: 6/12 to 6/36, Grade III: 6/36 to 6/60, Grade IV: 6/60 to PL+, Grade V: denies perception of light. Final visual acuity was divided into two categories Visual Acuity (VA) \geq 6/60 and VA $<$ 6/60. Follow up of all the patients was done at 1 month, 3 month and 6 month. Relative afferent pupillary defect was noted but it was not found in any case. Data analysis was done using Student's two-tailed t-test and chi-square test. Multivariate Logistic regression was used to identify independent risk factors after adjusting for other variables. Initial visual acuity was not included in multivariate analysis being a collinear variable with other risk factors.

Results

Out of 75 patients with open globe injury 57 (76%) were male and 18(24%) were female. Open globe injury was most common in males and p-value was significant (.000). Right eye was involved in 38 patients and left eye in 37 patients; p-value was not statistically significant (.908). In present study Zone I was involved in 40 (53.33%) patients, zone II in 26 (34.66%) patients and zone III in 9 (12%) patients. The age was in the range of 2-77 years and average age was 32.69 years. Out of 75 patients with open globe injury 23 patients were less than 23 years, 28 patients were between 21-40 years, 14 were between 41-60 years, 10 were more than 60 years.

In our study open globe injury was more in younger age group patients less than 40 years and p-value was significant (.013) (Table 1). The most common agent causing injury was wood in 29(38.66%) patients, stone in 16 (21.33%) patients, metal in 6(8%) patients, cow horn in 6(8%) patients, cracker in 3(4%) patients, glass in 3(4%) patients, chemical injury in 1(1.33%) patient and other agents including injury with pencil, knife, school bag in 11(14.66%) patients (Table 2).

Most of the injuries 30.66% occur in home, 28% injuries occurred while working in fields, 21.33% occurred in workplace in labourers, 4% injuries occurred in school, 9.33% injuries occurred while playing and 6.66% in road traffic accident (Table 3). Initial visual acuity $<$ 6/60 was present in 64 patients and \geq 6/60 was present in 11 patients p-value was significant (.000). Final visual acuity $<$ 6/60 was present in 44 patients and \geq 6/60 was present in 31 patients p-value was not significant (.133) (Table 4).

In Zone I injury 6 patients had visual acuity 6/60 before management and 25 patients had visual acuity 6/60 after management. In zone II injury 3 patients have visual acuity \geq 6/60 before management and 4 patients have visual acuity \geq 6/60 after management. In zone III injury, 2 patients have visual acuity \geq 6/60 before management and after management. There was no statistically significant difference in visual acuity related to zone of injury before management p-value is 0.734, but after management zone I injuries have good visual prognosis and p-value (.000) was significant. Based on occupation, out of 75 patients 14 were farmers, 13 worker, 11 housewives, 23 were students, 3 carpenter, 6 employees and 5 others (Table 5). In present study on univariate logistic regression hyphema (p-value=.00), uveal tissue prolapsed (p-value=.007), vitreous haemorrhage (p-value=.00), vitreous prolapse (p-value=.00), retinal detachment (p-value=.00), were found to be statistically significant prognostic factors for visual outcome. Based on multiple logistic regression hyphema (p-value=.023) was found statistically significant prognostic factors for visual outcome (Table 6). At the end of 6 months follow up, 40 patients had corneal scarring, phthisis bulbi was present in 9 patients, secondary glaucoma in 6 patients, endophthalmitis in two patients.

Age	Number	P-value
≤20	23	.013
21-40	28	
41-60	14	
≥60	10	
	75	

Table 1: Age wise distribution.

Agent	Number of Patients	Percent
Stone	16	21.33
Wood	29	38.66
Glass	3	4
Chemical	1	1.33
Iron Rod/Metal	6	8
Cracker	3	4
Cow Horn	6	8
Other	11	14.66
Total	75	

Table 2: Agents of trauma.

Place of Injury	Number of Patients	Percentage
Home	23	30.66
Fields	21	28
Workplace	16	21.33
School	3	4
Playing	7	9.33
Road Traffic Accident	5	6.66

Table 3: Place of injury.

Zone	Initial Visual Acuity Before Management		Total	P-value
	<6/60	≥6/60		
1	34	6	40	.734
2	23	3	26	

3	7	2	9	
	64	11	75	
Zone	Final Visual Acuity After Management		Total	P-value
	<6/60	≥6/60		.000
1	15	25	40	
2	22	4	26	
3	7	2	9	
	44	31	75	

Table 4: Visual acuity and zone of involvement.

Occupation	Number of Patients	Percentage
Farmer	14	18.66
Worker	13	17.33
Housewives	11	14.66
Student	23	30.66
Carpenter	3	4
Employe	6	8
Other	5	6.66

Table 5: Occupation of patients.

	Final Visual Acuity		Univariate Analysis	Multivariate Analysis	
	<6/60	≥6/60	P-value	Adjusted Odds Ratio	P-value
Hyphemia					
No	11	28	.000	8.95	0.023
Yes	33	3			
Uveal Tissue Prolapse					
No	12	18	.007	0.92	0.910
Yes	32	13			
Vitreous Hemorrhage					
No	17	27	.000	1.11	0.922
Yes	27	4			
Vitreousprolapse					
No	17	8	.000		

Yes	27	3		3.57	0.238
Retinal Detachment					
No	25	30	.000	6.96	0.129
Yes	19	1			
IOFB					
No	40	29	1.00	1.79	0.636
Yes	4	2			
Traumatic Cataract					
No	40	26	.475	0.87	0.889
Yes	4	5			
Zone					
1				1.17	0.865
2 and 3					

Table 6: Prognostic factors.

Discussion

Ocular trauma is the preventable cause of permanent vision impairment and blindness. The primary aim of treatment of the open-globe injury is to restore the structural integrity of the globe as early as possible. The risk factors that are associated with final visual outcome include age, mechanism of injury, initial visual acuity, presence of relative afferent pupillary defect, location of open globe injury, size of open globe injury, mechanism of injury, hyphema, trauma to lens, vitreous hemorrhage, retinal detachment and presence and intraocular foreign body. This study was done to evaluate the agents responsible for open-globe injury and identify risk factors responsible for the final visual outcomes. In present study 76% patients were males. Males are most commonly affected in our study as the males are more exposed to outdoor activities [8-10]. In our study 51 (75%) patients out of 75 patients were less than 40 years of age which is similar to previous studies [11]. According to the study by David, et al., patients less than 40 years accounted for 77% [12]. In present study Zone I was involved in 40 (53.33%) patients, zone II in 26 (34.66%) patients and zone III in 9 (12%) patients, so most of the injuries were in zone I involving cornea as cornea is more anteriorly situated and more exposed to penetrating injuries. DV Singh, et al., found 142 cases out of 292(50.68%) had zone 1 injury [13]. In present study the open-globe injury involving zone III had poor final visual outcomes compared to those involving zones I and zone II. In zone I injury 6 patients have visual acuity >6/60 before management and 25 patients have visual acuity > 6/60 after management. P-value was significant (.000) which is similar to previous studies, which reported a significant association between the posterior extension of the wound and a poor final visual acuity [14,15]. Madhusudhan, et al., reported that patients with a open globe injury extending posterior to the equator, Zone III had twenty times the risk of having a final visual acuity less than 3/60 as compared to patients whose open globe injury were anterior to the recti insertions or involving cornea. The present study showed that a poor visual acuity at the first visit was associated with poor final visual acuity which is an important prognostic factor and is similar to other studies.

A good initial visual acuity was the strongest prognostic factor of a favourable final visual acuity [16,17]. The most common agent of injury is wood in this study accounting to 38.66%. This is due to the fact that the main occupation of the people in the present study is agriculture. According to the study, Ocular Trauma in a rural population of southern India, injury with vegetable matter like thorn, stick, branch of a tree is the most common agent accounting to 45.3% [18]. According to a study, a two-year review of ocular trauma in Jimma University Specialized Hospital, wood was the commonest material accounting for 40.9% comparable to the present study [19]. In the present study, the commonest place where injury occurred was at home

accounting for 30.6% followed by fields (28%) similar to the study done by BK Malla, injuries at home were 44.5% followed by fields (29.7) [20]. In our study on univariate logistic regression analysis uveal tissue prolapse, hyphema, retinal detachment, vitreous hemorrhage and vitreous prolapse were poor prognostic factors for visual outcomes however in multivariate logistic regression hyphema was only factor for poor visual outcome. Similarly in other studies open globe injury with concomitant adnexal trauma, relative afferent pupillary defect, uveal tissue prolapse, hyphema, lens injury, retinal detachment, vitreous hemorrhage and endophthalmitis have poor visual outcomes [21,22]. Traumatic hyphema is an important risk factor for visual impairment following ocular trauma, as it reflects significant anterior segment injury and predisposes the eye to secondary complications such as raised intraocular pressure and rebleeding [23]. Although many cases resolve with conservative management, hyphema increases the risk of secondary hemorrhage, corneal blood staining and traumatic glaucoma, which may adversely affect final visual acuity [24]. Clinical studies have demonstrated that poor presenting visual acuity, larger hyphema size and associated ocular injuries are significant predictors of unfavorable visual outcomes [25]. Hence, hyphema serves as a useful clinical marker of ocular trauma severity and visual prognosis, highlighting the importance of careful monitoring and timely intervention [26].

Limitation of Study

Present study was done in one centre hence sample size was small, which limits the accurate statistical analysis. Open globe injuries rarely occur in isolation, they are often associated with complex, multiple injuries or systemic health conditions that can act as confounding factors in evaluating the visual prognosis.

Conclusion

The prompt diagnosis and timely mediation is warranted in the patients sustaining open-going injury to prevent devastating visual impairment and blindness. In present study, zone III injury, uveal tissue prolapse, vitreous haemorrhage, vitreous prolapsed showed poor visual outcome but Hyphema came out to be important prognostic factor associated with poor visual outcome in patients with open globe injuries.

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Data Availability Statement

Not applicable.

Ethical Statement

The project did not meet the definition of human subject research under the purview of the IRB according to federal regulations and therefore, was exempt.

Informed Consent Statement

Informed consent was taken for this study.

Authors' Contributions

All authors contributed equally to this paper.

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